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ABSTRACT

This report describes National Institute of Health policies on animal welfare, the 1976 amendment to the Animal Welfare Act, and relevant portions of the Endangered Species Act of 1973. It is divided into four sections on the following topics: (1) laboratory animal management; (2) laboratory animal quality and health; (3) institutional policies; and (4) physical plant. A committee on the care and use of animals is recommended as an effective device in overseeing treatment at the institutional level. Details of proper care have been set out for most common laboratory animals. (BB)

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GUIDE FOR THE CARE AND USE OF LABORATORY ANIMALS

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GUIDE FOR THE CARE AND USE OF LABORATORY ANIMALS

prepared by the
Committee on Care and Use
of Laboratory Animals
of the
Institute of Laboratory Animal Resources
National Research Council

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NOTICE

The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the Councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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The Institute of Laboratory Animal Resources (ILAR) was founded in 1952 in the Division of Biology and Agriculture of the National Research Council. As a component of the Division of Biological Sciences, Assembly of Life Sciences, ILAR serves as a coordinating agency to disseminate information, survey existing and required resources, establish standards, promote education, hold conferences, and generally upgrade laboratory animal resources.

Preface

The *Guide for the Care and Use of Laboratory Animals* was first published in 1963 under the title *Guide for Laboratory Animal Facilities and Care*. It was revised in 1965, 1968, and 1972, when it was given its current title to reflect the enlarged scope of the recommendations for the care and use of animals. More than 250,000 copies of the *Guide* have been distributed since it was first published, and it is accepted as a primary reference on standards of animal care in scientific institutions. The changes and the new material in this edition are in keeping with the belief that it must be a living document, subject to change with changing conditions and new information.

The purpose of the *Guide* is to assist scientific institutions in using and caring for laboratory animals in ways judged to be professionally appropriate. The recommendations are based on scientific principles, expert opinion, and experience with methods and practices that have proved to be consistent with high quality animal care.

The *Guide* provides information with broad applicability under a variety of circumstances. Many different animal species are used in scientific research, and the *Guide* provides essential information on their proper care. However, supplemental information on particular animal species is often desirable, and the Institute of Laboratory Animal Resources (ILAR) publishes species-oriented documents on the breeding, care, and management of selected laboratory animals. Information in these publications is not intended to supplant principles in the *Guide*, but rather to be adjunctive.

This edition of the *Guide* was prepared by the ILAR under contract NO1-RR-5-2128, administered by the Animal Resources Program, Division of Research Resources, National Institutes of Health. Readers who detect errors of omission or commission are invited to send corrections and suggestions to the Institute of Laboratory Animal Resources, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

The manuscript was edited by Mr. Norman Grossblatt, Assembly of Life Sciences.

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Introduction

The scientific community has long recognized a scientific and ethical responsibility to provide appropriately for the welfare of animals used for research and education in biology and medicine. The principles stated herein acknowledge this responsibility and constitute a definition of humane laboratory animal care. The Committee on the Care and Use of Laboratory Animals believes that the operation of institutional animal facilities should be in accord with the recommendations presented in this *Guide*.

Nothing in the *Guide* is intended to limit an investigator's freedom—indeed, obligation—to plan and conduct animal experiments in accord with accepted scientific practice, and it is hoped that the *Guide* will encourage investigators to seek new and better methods of laboratory animal care. Finally, it should be understood by all who use the *Guide* that *it is deliberately written in general terms so that the recommendations may be applied in the diverse scientific institutions that use animals for education and research; professional judgment is essential in the interpretation of these recommendations.*

I. Laboratory Animal Management

The proper management of laboratory animal facilities depends on many subjective and objective factors that interact differently in different institutions. Well-trained and motivated personnel can ensure high-quality animal care even in the presence of deficiencies in the physical plant or housing equipment. For the purposes of the *Guide*, "proper management" is defined as any system of housing and care that permits animals to grow, mature, reproduce, and behave normally and to be maintained in physical comfort and good health. "Proper management" also implies environmental and genetic control to minimize variations that may modify an animal's response to a particular experimental regimen. Proper management of laboratory animals is essential to the welfare of the animals, to the validity of research data, and to the health and safety of the animal-care staff.

A. Housing

1. *Criteria for Evaluating a Caging or Housing System*

The caging or housing system is one of the most important elements in the physical environment of laboratory animals. Inasmuch as the well-being of the animals and the control of experiments are influenced by the caging or housing system, it should be designed carefully. The following criteria may be used to evaluate the caging or housing system (hereinafter referred to as the "system"):

- The system should be designed with the animals' physical comfort as a primary consideration. Physical comfort, as applied specifically to housing, includes such factors as keeping the animals dry and clean, or providing an appropriate aquatic or marine environment; keeping the animals at a comfortable temperature; providing sufficient space to permit freedom of movement and normal postural adjustments; avoiding unnecessary physical restraint; providing convenient access to clean food and water; and, if animals are housed in groups, preventing overcrowding.
- The functional operation of the system should be compatible with maintenance of animals in good health, as indicated by such things as normal growth and development and the prevention of diseases.
- The system should be designed to facilitate effective sanitary

maintenance and servicing. For example, bends and crevices in animal cages that may be difficult to clean should be avoided, and feeding and watering devices should be easily accessible for filling, changing, or servicing.

- Throughout the system, keeping the cages, runs, and pens in good repair should be considered mandatory to prevent injury to the animals, to promote physical comfort, and to facilitate effective sanitary maintenance and servicing. Particular attention should be given to avoiding sharp edges and broken wires, to keeping cage floors in good condition, and to refurbishing or replacing rusted equipment.

- The system should meet the investigator's research requirements. Rarely are the animal housing requirements incompatible with the requirements for research. Animals may need to be housed singly or in groups, in cages, runs, or pens. When hazardous biologic, chemical, or physical agents are used, special housing facilities may be needed to satisfy the requirements for both research and safety.

2. *Exercise*

One of the most widely debated subjects in the field of animal care is the need for "exercise" in the housing of laboratory animals, particularly dogs. Confinement in cages has been equated by some with lack of exercise and with physical or psychologic discomfort, and regular release from cages with exercise and with physical or psychologic well-being. However, confinement in a cage does not necessarily influence the amount of exercise an animal engages in, and it does not necessarily affect an animal's well-being.

For this *Guide*, "exercise" is defined as any physical activity, and it is believed that whether dogs and other animals are exercised and the form of the exercise are subject to professional judgment. Breed and temperament, an animal's history and physical condition, the nature of the research, and the expected duration of confinement should be considered in determining the need for supplementary exercise. If professional judgment indicates that supplementary exercise is needed, it may be provided in any of several ways, such as by the use of a treadmill or exercise wheel, by walking the animal on a leash, by providing access to a run, or by releasing the animal from its cage into an animal room.

Cages are often necessary or useful for intensive postsurgical care, isolation of sick animals, metabolic studies, and short-term holding of dogs (for 1–3 months). There are, however, practical reasons for providing pens, runs, or other out-of-cage space in all dog housing areas. They provide more opportunity for exercise, and they are convenient for holding dogs while their cages are being

cleaned; and dogs also can be accommodated very comfortably for long periods of time in such enclosures.

Professional judgment should be applied in determining exercise needs of large domestic animals, such as horses and cattle. If exercise is needed, loafing areas, exercise lots, pastures, and controlled exercise are suitable.

3. *Restraint*

The use of restraint chairs or similar devices is sometimes necessary in research. The following considerations should guide investigators in the use of restraint equipment:

- The period of restraint should be the minimum required to accomplish the research objectives.
- Restraint in chairs or similar devices is not to be considered a "normal" method of laboratory housing, although it may be required for a specific research objective.
- Restraint chairs or similar devices should not be used simply as a convenience to the investigator in the handling or management of animals.
- When animals are restrained in chairs or similar devices, particular attention must be paid to the possible development of lesions or illnesses that may be associated with continuous restraint. For example, animals should be monitored for contusions, decubital ulcers, dependent edema, and weight loss. If any of these problems occur, the attending veterinarian may decide that local treatment or temporary or permanent removal of an animal from the restraint device is required.

B. Sanitation

1. *Cleanliness*

Animal facilities should be kept clean, neat, and uncluttered. A schedule of regular sanitary maintenance is necessary, and it should include elimination of hazardous biologic, chemical, and physical agents. Animal rooms, corridors, storage spaces, and other areas of an animal facility should be cleaned as often as necessary, and appropriate detergents and disinfectants should be used to keep them free of dirt, debris, and harmful contamination.

If litter or bedding is used in cages or pens, it should be changed as often as necessary to keep the animals dry and clean and to minimize odors. For routine maintenance of small rodents—such as rats, mice, and hamsters—one to three bedding changes per week

will probably suffice. For larger animals—such as dogs, cats, primates, and large domestic animals—daily removal of soiled litter material may be necessary. If animal waste must be removed by hosing or flushing, it may be necessary that this be done at least once a day. Special measures may be necessary to keep the animals dry during such cleaning. Litter should be emptied in a manner that minimizes exposure of animals and personnel to aerosolized waste. This procedure should be performed in an area other than the animal rooms.

Animal cages, racks, aquaria, and accessory equipment—such as feeders and watering devices—should be washed and sanitized as often as necessary to keep them clean and free from contamination. Ordinarily, this can be achieved by washing cages and accessories once or twice a week and racks every two weeks.

Cages should be sanitized before animals are placed in them. It is good practice to have extra cages available at all times to allow for a systematic cagewashing schedule. Washing and rinsing should be conducted at a temperature of 82.2° C (180° F) or higher for a period long enough to ensure destruction of vegetative pathogenic organisms. Disinfection may also be accomplished with appropriate chemicals, provided equipment is rinsed free of traces of chemicals prior to use. For some experiments, it may be necessary to sterilize (e.g., autoclave) cages and equipment. Periodic microbiologic monitoring is useful to determine the efficacy of disinfection or sterilization procedures. Where hazardous biologic, chemical, or physical agents are used, a system of equipment monitoring should be instituted.

Waste containers and implements should be kept in sanitary condition. It is good practice to line waste cans with disposable liners and to wash each waste can every time it is emptied, with the same methods as suggested above for sanitizing animal cages.

2. *Waste Disposal*

All waste should be collected, removed, and disposed of in a safe and sanitary manner. If waste cans are used, they should be made of metal or plastic, be leakproof, and be equipped with tight-fitting lids. It is advisable to use leakproof disposable liners in waste cans, for disposal of animal tissues, carcasses, and hazardous wastes (see Section IV.G). Hazardous wastes should be rendered safe by autoclaving, containment, or other appropriate means before they are removed from the animal facility.

Waste materials should be removed regularly and frequently. If storage of waste before removal is necessary, the storage area should be separated from other storage facilities and free of flies, cockroaches, rodents, and other pests. Cold storage to prevent decomposition of biologic waste may be required before disposal.

Most states and municipalities have statutes or ordinances controlling disposal of wastes. Compliance with these requirements is an institutional responsibility (see Section III.F).

3. *Vermin and Odor Control*

Programs should be instituted to control or eliminate cockroaches, flies, escaped or wild rodents, and other similar pests. All breeding sites should be sealed or eliminated, and pesticides or traps should be used as necessary in conjunction with a strict program of sanitary maintenance. To prevent toxic effects in research animals and possible interference with experiemtanl procedures, pesticides (including insecticide-impregnated plastic materials) should be used only under professional supervision. Harmful accumulations of pesticides in the environment and their disposal in undesirable quantities in public waste systems should be avoided.

C. Husbandry

Animal husbandry is an important factor in research. Husbandry procedures, although generally considered to be routine, can significantly affect research data.

1. *Food and Bedding*

To ensure that food and bedding do not serve as means of introducing diseases, parasites, potential disease vectors (such as insects), or chemical contaminants into animal colonies, breeders and users of laboratory animals should exercise caution in the purchase, transportation, storage, and handling of these products.

All laboratory animals should have daily access to food according to their particular requirements. Food should be presented in a manner that minimizes contamination with wastes. It should be fed in amounts sufficient to ensure normal growth in immature animals and maintenance of normal body weight in adults. The food should be clean, free of contaminants, palatable, and nutritionally adequate. Purchasers are encouraged to become familiar with manufacturers' and suppliers' practices and to ensure, by periodic analyses, that appropriate standards are being met.

The date of manufacture of the food should be known by the user. Food more than 90 days old may be deficient in nutrients. The amounts of food stored should be sufficient to meet the demand for animal maintenance with optimal rate of turnover. Nutritional quality may be preserved and shelf-life lengthened if food is stored at 15.5° C (60° F) or less. Refrigeration should be available for meats, fruits, vegetables, and other perishable items. Precautions should be taken if

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such perishable items are fed, because they are potential sources of biologic and chemical contamination and may lead to variation in the amount of nutrients consumed.

Bacteriologic testing may be required to detect the presence of pathogens in food. Because chemical contaminants have also been reported in animal food, it may be desirable to conduct periodic assays for contaminants that could interfere with a particular study. For example, excessive concentrations of estrogen will interfere with breeding. Animal food may also become contaminated with antibiotics—the residue from milling apparatus that has been used to mix medicated food for farm animals; periodic testing of food for antibacterial activity might therefore be warranted for some types of experiments.

The selection of bedding or litter will depend on whether there is to be animal contact with the material. In general, bedding or litter should be absorbent and free of substances that could injure animals or personnel. Bedding should be of a type not readily eaten by the animals. Enough bedding should be placed in a cage to keep the animals dry between cage changes. It should not come into contact with watering tubes. Some bedding materials may contain substances that affect the biologic responses of animals to some experimental procedures (see Appendix I for references on environmental contaminants).

2. *Water*

Laboratory animals should have daily access to water, according to their particular requirements. The water should be potable and free of harmful contaminants. Periodic monitoring may be necessary to ensure that the water is acceptable. Ordinarily, drinking water should be available at all times unless adequate water is supplied in the diet. Water should be presented in a manner that minimizes contamination with wastes. Watering devices, such as drinking tubes and spouts and automatic waterers, should be examined routinely to ensure their patency. It may be necessary to train animals to use automatic watering devices.

3. *Identification and Records*

Methods of animal identification include: room, rack, and cage cards; collars, bands, plates, and tabs; colored stains; ear notches and tags; tattoos; and freeze brands. An identification card should include such information as the source of the animal, the strain or stock, the name and location of the responsible investigator, and pertinent dates. A research protocol may require identification of individual

animals. Records on experimental animals are essential and should include notations on the source and eventual disposition of each animal.

4. *Provisions for Emergency, Weekend, and Holiday Care*

Provisions should be made for emergency care of animals. Institutional security personnel and fire or police officials should know how to reach a person responsible for the animals. This can be accomplished by prominently posting the names of such responsible persons in the animal facilities or by listing them with the institution's central telephone center or security department. The objective is to ensure that animals will be cared for in case of emergencies.

Provisions should be made for observation and care of animals every day, including weekends and holidays, both to safeguard their well-being and to satisfy research requirements.

II. Laboratory Animal Quality and Health

A. Veterinary Care

Adequate veterinary care should be provided by a veterinarian qualified by postdoctoral training (see Appendix III for references to professional education) or pertinent experience. Such care includes: full-time or regularly scheduled attendance by a veterinarian with a frequency appropriate to institutional needs; oversight responsibility for animal husbandry programs; frequent observation of all animals by a person qualified to verify the health of each animal; availability of veterinary medical service for animals found to be ill or injured; application of currently accepted measures of prophylaxis and therapy appropriate for each species; establishment of procedures for disease containment and surveillance; consideration of humane aspects of animal experimentation, such as the proper use of anesthetics, analgesics, and tranquilizing drugs; appropriate surgical procedures and postsurgical care; and proper euthanasia procedures.

1. *Quarantine and Isolation of Animals*

"Quarantine" is the separation of newly received animals from those already in the facility until the health of the newly received animals has been evaluated. This evaluation should be made in accordance with acceptable veterinary medical practice. Applicable local, state, or federal regulations pertaining to health of animals must be followed. For rats, mice, and hamsters—when obtained from reliable sources—the quarantine may be limited to the time necessary for inspection upon arrival; for these and similar species, control of quality at the source and knowledge of the environmental history of the animals are acceptable as a part of the institution's quarantine protocol. If the environmental history of an animal is unknown—as is commonly the case with dogs, cats, nonhuman primates, and large domestic animals—the quarantine procedure should be more comprehensive.

The quarantine period is often used to condition animals. During this period, some or all of the following may be performed:

- Determination of whether the animals are appropriate for the intended use.
- Physical examination of the animals, including appropriate clinical and laboratory diagnostic tests and appropriate treatment.

- Diagnosis, control, and prevention of diseases, including zoonoses.
- Physiologic and nutritional stabilization of the animals.
- Grooming, including bathing, dipping, and clipping as required.

"Isolation" is the separation of animals that are known to be or suspected of being diseased, or known to be or suspected of carrying disease, from animals that are in good health. When infectious hazards are recognized, the animals involved should be isolated from all other animals by placing them in isolation units or separate rooms.

2. *Prevention, Diagnosis, Treatment, and Control of Animal Diseases*

All laboratory animals should be observed daily for clinical signs of illness, injury, or abnormal behavior by a person trained to recognize such signs. All deviations from normal and all deaths from unknown causes should be reported promptly to the person responsible for animal disease control.

Veterinary medical service should be provided on a timely basis to ill or injured animals. Currently accepted measures of diagnosis, therapy, and prophylaxis should be applied as appropriate. Control and treatment of animal diseases and other abnormalities require an appropriate quarantine program and perhaps microbiologic monitoring of source colonies and surveillance of newly received animals and animal tissues for disease.

Diagnostic laboratory services supplement the physical examination of animals and facilitate the proper diagnosis of abnormal conditions. These services should include necropsy, microscopic examination of animal tissues, isolation and identification of specific pathogens, and other appropriate laboratory procedures.

3. *Separation by Species and Source*

The physical separation of animals by species usually is necessary to protect against interspecies transmission of infectious diseases, to prevent anxiety due to interspecies conflict, and to meet experimental and environmental requirements. This separation is best accomplished by housing species in separate rooms. It may also be advisable to house animals from different sources in separate rooms.

The following are a few examples of the considerations that should guide those who must determine the need for separate housing by species:

Some species may carry subclinical or latent viral infections that can be fatal when transmitted to other species. For example, *Herpesvirus tamarinus* may cause mild stomatitis in squirrel monkeys (*Saimiri sciureus*), but fatal epizootics have followed natural transmission of

the virus from squirrel monkeys to owl monkeys (*Aotus trivirgatus*) and some marmosets (*Saguinus* sp.). Thus, squirrel monkeys should not be housed in the same room with these species. *Herpesvirus simiae* (B virus) infects Asian monkeys, especially the rhesus (*Macaca mulatta*) and cynomolgus (*Macaca fascicularis*). It is best to house them apart from other nonhuman primates. Nonhuman primates of African origin should be housed apart from other primates to protect against spread of viruses, such as Yaba or Yaba-like and simian hemorrhagic fever. Apes should be separated from other nonhuman primates and should have limited contact with man, because they may be carriers as well as victims of diseases of man, such as tuberculosis, infectious hepatitis, variola, rubeola, and poliomyelitis. Rabbits should be housed in separate rooms because they frequenly harbor organisms such as *Pasteurella* sp. and *Bordetella* sp. that are infectious to cats, nonhuman primates, guinea pigs, and other animals; furthermore, rabbits are maintained more comfortably at lower temperatures than those suitable for most other common laboratory animals. Laboratory rats and mice should be caged in separate rooms, if possible. *Streptobacillus moniliformis*, a commensal found in the nasopharynx of rats, has caused fatal septicemia in mice housed in rooms with rats.

4. *Anesthesia and Analgesia*

The proper use of anesthetics, analgesics, and tranquilizers in laboratory animals is necessary for humane and scientific reasons. In accordance with the Animal Welfare Act, the choice and use of the most appropriate drug(s) are matters for the professional judgment of the attending veterinarian. Research personnel must be provided with guidelines and consultation concerning choice and use of these drugs.

If a procedure must be conducted without the use of an anesthetic, analgesic, or tranquilizer—because such use would defeat the purpose of an experiment—the procedure must be directly supervised by the responsible investigator in agreement with institutional policies and local, state, or federal regulations.

Muscle relaxants or paralytic drugs (e.g., succinylcholine or other curariform drugs) are not anesthetics, and they should not be used alone for surgical restraint. They may be used for surgery in conjunction with drugs known to produce adequate analgesia.

5. *Surgery and Postsurgical Care*

Appropriate facilities and equipment should be available for surgical procedures. A facility intended for aseptic surgery should be used only for that purpose and should be maintained and operated to ensure its cleanliness. Aseptic technique should be used on most

animals undergoing survival surgery. Clean but not necessarily aseptic techniques may be used for rodents and lagomorphs.

Facilities for aseptic surgery should be directed and staffed by appropriately trained personnel. Surgery should be performed only by persons qualified by training and experience. Provisions should be made for instruction in aseptic surgery for those who require training.

Postsurgical care should include observation of the animal until it has recovered from anesthesia, administration of supportive fluids and drugs, care of the surgical incisions, and observation to ensure the animal's physical comfort and optimal recovery. Appropriate medical records should be maintained. Trained personnel should be available to deal with emergencies. Appropriate facilities and equipment should be available for the postsurgical care of animals (see Section IV.E for a discussion of facilities needed for aseptic surgery).

6. *Euthanasia*

Euthanasia should be performed by trained persons in accordance with institutional policies and applicable laws. The choice of method depends on the species of animal and the project for which the animal was used. The method of euthanasia should not interfere with postmortem examinations or other procedure. Approved procedures for euthanasia shou'd follow guidelines currently established by the American Veterinary Medical Association Panel on Euthanasia. Animals of most species can be killed quickly and humanely by intravenous or intraperitoneal injections of highly concentrated barbiturate solutions. Mice, rats, and hamsters can be killed by cervical dislocation or by exposure to nitrogen gas or carbon dioxide in an uncrowded chamber. Ether and chloroform are also effective, but their use is hazardous to personnel: ether is flammable and explosive, and chloroform is toxic and may be carcinogenic. *If animals are killed by ether, special facilities and procedures are required for storage and disposal of carcasses.* Storage in non-explosion proof refrigeration equipment and disposal by incineration can result in serious explosions. Signs indicating the use or presence of these toxic or explosive agents should be conspicuously posted.

B. Multiple-Survival Surgery

Generally speaking, multiple-survival surgical procedures on a single animal are discouraged. However, under special circumstances, more than one major surgical procedure on a single animal may be permitted with the approval of those concerned with institutional animal care policies, provided they are related components of a

research or instructional project, they are performed with adequate anesthesia, after-care is designed to alleviate postsurgical pain, and adequate postoperative care is provided. Cost alone is not an adequate reason for performing multiple-survival surgical procedures on an animal but such procedures may be justified in the interest of conserving members of a rare species.

C. Genetics

Genetic characteristics are among the most important factors to be considered in selecting animals for use in biomedical research. Experimental results reported by previous investigators may be impossible to reproduce when the experiment is repeated on animals obtained from different sources, even though they are of the same strain or stock name. Genetic characteristics change when animals of the same strain or stock name are maintained in a different location for several generations. Some of the genetic changes produce visible differences—e.g., in color—and others influence more subtle characteristics, such as metabolism, longevity, disease resistance, and immune response.

D. Nomenclature

Accurate identification and recording of the strain or genetic background of animals used in a research project are important. Failure to document such information and publish it in research reports makes it difficult, if not impossible, to duplicate an experiment in other laboratories.

The most frequent omissions occur in describing random-bred stocks of mice and rats. Designations based on origin—e.g., "Swiss mice," "Wistar rats"—are often used despite the fact that producers and suppliers have devised special, differentiating terms to provide more accurate identification.

If standardized strains of animals cannot be obtained from commercial sources, it may be impossible to describe an animal's origin precisely. In such cases, one should identify an animal by taxonomic classification, by commercial source, and, in the case of a feral or wild animal, by the location of its capture.

In an effort to reduce the variations caused by environmental differences, certain microbiologic terms are used to describe animals—e.g., "germfree," "axenic," "gnotobiotic," "specific-pathogen-free," and "conventional." The intent of these terms is to define an animal's relationship to its environment. Unfortunately, the misuse of these terms has caused confusion, rather than clarification. To ensure accurate interpretation, these environmental relationships should always be carefully defined.

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E. Environmental Factors Affecting Laboratory Animals

Good laboratory animal management includes consideration of environmental factors to which animals are exposed and their possible effects on the well-being of the animals and on their biologic responses to specific experimental manipulations. Environmental factors known to modify animals' biologic responses are exposure to various chemicals and drugs, method of handling, population density, cage type, noise, photoperiod, temperature, humidity, and ventilation.

Insecticides, even in exceedingly low concentrations, can induce or inhibit hepatic microsomal enzyme activity in animals, as can such chemical contaminants as eucalyptol and vinyl chloride, which are ingredients in many disinfectants and air fresheners.

Food and bedding can be sources of chemical contamination. For example, pesticides used on crops and stored food can cause enzyme changes and tissue injury. Heavy metals in food can affect experimental results: lead, a common contaminant, affects the renal and central nervous systems; cadmium can cause hypertension; and mercury can cause tissue injury, especially in fetuses and immature animals.

Molds grow on natural products, and some may cause mycotoxin contamination of food and bedding. These potent toxins may cause subtle changes in the structure and function of various body systems, and some are carcinogenic.

Estrogenic substances, particularly diethylstilbestrol, may be contaminants in food and can have significant adverse effects on breeding colonies. Antibiotics are sometimes food contaminants and can affect intestinal microflora, growth rate, and disease resistance.

Bedding materials may contain substances that have significant effects on an animal's biologic responses. Pine and cedar, for example, are known to cause changes in hepatic microsomal enzymes of mice and rats; therefore, they should not be used (see Appendix I for references on environmental contaminants).

III. Institutional Policies

A. Monitoring the Care and Use of Animals

Proper care and humane treatment of animals during their use in research and education require scientific and professional judgment. This implies specific knowledge of the needs of the animals, the requirements of the research and educational programs, and the setting in which the research or teaching is to be conducted. The guidelines in this section are intended to aid in developing institutional policies governing animal research.

A committee on the care and use of animals is an effective device for developing and monitoring policies to guide animal care and use in keeping with institutional requirements. The membership of the committee should be representative of the various users, and at least one of the members should be a doctor of veterinary medicine. The committee should be responsible for evaluating the animal care program in regard to the maintenance of acceptable standards for the care, use, and treatment of animals in research and education (see Appendix V).

B. Veterinary Care

Provision of adequate veterinary care is an institutional responsibility (see Section II.A).

C. Personnel Qualifications

The number and qualifications of personnel required to conduct and support animal care programs depend on several factors. Among these are the type and size of institution, the administrative structure for animal care, the physical plant, the number and species of animals maintained, and the nature of teaching, testing, or research activities.

1. *Animal Resource Professional Personnel*

Animal care programs require professional direction in addition to that provided by the user of the animal. The functions of such programs may include the provision of a broad range of laboratory,

clinical, research, and animal husbandry services. These programs should be directed by veterinarians who have special training or experience in laboratory animal medicine (see Appendix III).

The employment of a full-time staff specifically concerned with the animal care program is highly recommended. This includes the professional and supporting personnel necessary to implement portions of the program concerned with veterinary medical care, animal husbandry, and administration. If it is not feasible in a given institution to employ a large staff for the animal care program, because the number of animals maintained is small, the part-time employment of veterinarians with training or experience in laboratory animal medicine may provide adequate veterinary care at the institution.

2. *Animal Care Personnel*

Animal care programs require administrative, technical, and husbandry support. Scientific institutions should employ such specialists or provide formal and on-the-job training and supervision of personnel to ensure effective implementation of the animal care program. Courses of education and training in animal technology are offered in numerous institutions (see Appendix IV), and there is a national certification program for animal technicians.

3. *Investigative Staff*

It is an institutional obligation to ensure that professional and technical personnel who carry out animal anesthesia, surgery, or other experimental manipulations are qualified through training and experience to accomplish these tasks in a humane and scientifically acceptable manner. Special programs for training of technicians, faculty, and undergraduate, graduate, and postdoctoral students may be necessary and should be provided as appropriate.

4. *Special Qualifications*

The professional and animal care staff should have specialized knowledge and skills when they conduct and support research programs involving hazardous biologic, chemical, and physical agents. The professional staff should be qualified to assist in the assessment of hazards associated with a proposed program involving potentially hazardous agents and should be capable of selecting safeguards appropriate to the assessed hazards. The animal care staff should be trained to understand the hazards of the research programs and should be proficient in implementing the required safeguards.

D. Personal Hygiene

The maintenance of high standards of personal cleanliness among the personnel dealing with animals is obligatory. The facilities and supplies necessary for meeting this obligation should be provided.

To aid in maintaining a high standard of personal hygiene, laboratory clothing suitable for use in the animal facility should be provided and laundered by the institution. This clothing should be changed as often as necessary to enable personnel to keep clean. Suitable facilities should be available for storage of street clothing during the workday.

Eating, drinking, and smoking by personnel should not be permitted in animal rooms. There should be a separate area or room for these purposes.

E. Occupational Health

An occupational health program is mandatory for personnel working in laboratory animal facilities and for other personnel with substantial animal contact. The program should include preplacement physical examinations, and, for personnel in some specific job categories, periodic physical examinations are advisable. Specific occupational hazards, both real and potential, should be recognized and prevented. An immunization schedule appropriate to the animal care program should be developed. For example, those handling carnivores, bats, or other species with substantial risk of carrying rabies should be afforded opportunity for protection by preexposure immunization. It is important to immunize animal care personnel against tetanus.

Zoonosis surveillance should be an essential part of the occupational-health program. An adequate surveillance program should include permanent records of individual work assignments. Records concerning bite wounds and unusual illnesses should be retained by the institution. Personnel should be instructed to notify their supervisors of suspected health hazards. Consideration should be given to obtaining and storing individual preplacement and postemployment serum samples for future diagnostic purposes.

Primate diseases that are transmissible to man can be a serious hazard to personnel. Personnel (including animal technicians, investigators, students, research technicians, maintenance workers, and guards) who have contact with nonhuman primates should undergo regularly scheduled examinations for tuberculosis. Protective clothing—such as gowns, gloves, masks, and face shields—should be available for use in handling primates.

There should be appropriate methods for monitoring radiation

exposure, accumulation of toxic material in tissues, and physical damage resulting from noise and any other hazards. Protective devices and other appropriate safety measures consistent with the state of the art should be provided.

F. Experimentation Involving Hazardous Agents

Institutions in which hazardous agents are used in animal experimentation should have policies governing the requirements that must be met if such experimentation is to be allowed and should have formal safety programs to assess the hazards, to determine the safeguards needed to control hazards, to determine the staff competence and the adequacy of facilities required for safe conduct of such experimentation, to approve such experimentation, and to monitor approved experimentation. These functions could be performed by either an appointed committee whose members are qualified through experience and expertise or an operating institutional environmental health and safety program. It is recommended, however, that a committee be established to evaluate and interpret issues relating to experiments involving hazardous agents and that an operating safety program be established to provide technical support and to ensure compliance with institutional policy. The use of some hazardous agents in animal experimentation requires compliance with guidelines or regulations issued by granting institutions or regulating authorities before work can begin (see Appendix I for references on biohazards in animal research).

Any persons using radioactive materials that are not exempted by law must be licensed by proper authority. The license application ordinarily requires a statement concerning the training and experience of the applicant; the location in the institution where the radioisotope will be used, including animal rooms; the availability of radiation safety devices; methods of waste disposal; and the records to be maintained. Periodic inspections are performed by the licensing authority to determine that experiments are conducted in strict accordance with the safety requirements.

IV. Physical Plant

The physical condition and design of animal facilities, to a great extent, determine the efficiency and economy of their operation and greatly influence the implementation of standards for animal care and use. A well-designed, properly maintained facility is an important element in good animal care. This section deals with the design and construction characteristics that must be considered in the planning and operation of animal facilities.

A. Functional Areas

The design, scope, and size of an animal facility depend on the nature of the research activities, the animals to be housed, the physical relationship to the rest of the institution, and the geographic location. The following functional areas are considered essential in a modern animal facility:

- A separate building, a separate wing, one or more floors, or separate rooms for housing the animals—enough animal rooms or areas are required to ensure separation of species or isolation of individual projects when necessary; to receive, quarantine, and isolate the animals; and to provide for their routine and special housing.
- Specialized laboratories or individual areas contiguous with or near the animal housing areas for such activities as surgery, intensive care, necropsy, radiography, preparation of special diets, experimental manipulation of animals, and the diagnosis, treatment, and control of laboratory animal diseases.
- Special facilities or provisions for the use of hazardous biologic, physical, or chemical agents, if such agents are to be used.
- Receiving and storage areas for food, bedding, pharmaceuticals and biologics, supplies, and equipment.
- Space for the administration, supervision and direction of the facility.
- Showers, sinks, lockers, and toilets for personnel.
- A separate area for eating, drinking, and smoking.

- An area for washing and sterilizing equipment and supplies—depending on the volume of work, a well-equipped cleaning area may include a cage-washing machine; a bottle- or glassware-washing machine; a rack-washing machine or area; a waste-can-washing machine or area; a utility sink; an autoclave for equipment, food, and bedding; and separate areas for holding soiled and clean equipment.
- Either an incinerator that can burn all animal waste and refuse or facilities for safe and sanitary storage of such waste before removal.

B. Service Areas in Relation to the Total Size of the Animal Facility

It is difficult to state categorically which service areas are required for an animal facility of a given size. However, in general terms, a facility should have provisions for the following service functions:

- Receiving of animals, animal food, and supplies.
- Quarantine.
- Isolation.
- Storing of animal food and supplies.
- Cleaning, sanitizing, and storing of cages and equipment.
- Repairing of cages and equipment.
- Collecting and disposing of waste.
- Supervision and administration.
- Diagnostic laboratory support.
- Lavatories, showers, and lockers for personnel.

The size of a facility will determine whether some of the service functions can be performed in a multipurpose area separate from animal housing. In general, facilities of 465 m^2 (5,000 ft^2) or more should have provisions for all the service functions just listed. In smaller facilities, some service functions may need to be performed in a multipurpose area separate from animal housing. If the animal facilities are widely dispersed, some duplication of service areas may be required.

C. Physical Relationship of Animal Facilities to Research or Teaching Laboratories

Animal housing areas support research or teaching laboratories. Good animal husbandry and human comfort require separation of animal facilities and personnel areas, such as offices, conference rooms, and laboratories. This can be accomplished by having the

animal quarters in a separate wing or on a separate floor in a multistory building or by providing a separate building for animal housing. A one-story building for animal housing usually permits the most efficient and economical animal care, in that vertical transport is avoided. However, this may not be the most desirable choice for research workers, because of the distance from their laboratories. In the planning of animal facilities, efficiency and economy in utilizing research workers' time must be considered. Careful planning should make it possible to place the animal housing areas adjacent to or near investigators' laboratories, but they should be separated from the laboratories by barriers, such as entry locks, corridors, or floors. Modular units such as specially designed trailers or prefabricated structures, should be in accord with the construction guidelines stated in the following section.

Many institutions have developed facilities for breeding, conditioning, isolating, and quarantining farm-type animals and for holding them over long periods.

D. Construction Guidelines

Building materials should be selected to facilitate efficient and hygienic operation of animal quarters. Durable, waterproof, fire-resistant, seamless materials are most desirable for interior surfaces. Paints and glazes, in addition to being highly resistant to the effects of chemical solvents, cleaning agents, and scrubbing, should be highly resistant to the effects of high-pressure sprays and impact. Construction should conform to local regulations (e.g., building codes) and institutional rules.

1. *Corridors*

Corridors should be at least 7 ft (2.1 m) wide to facilitate the movement of personnel and equipment. Floor-wall junctions should be coved, to facilitate cleaning. Provisions should be made for curbs, guardrails, or bumpers to protect the walls from damage. Exposed corners should be protected by being reinforced with steel or other durable material. Corridors leading to dog kennels should be provided with noise traps such as double-door entry locks. Wherever possible, access to such utilities as waterlines, drainpipes, and electric connections should be through service panels or shafts in the corridors outside the animal rooms.

2. *Animal Room Doors*

Doors should open into the animal rooms. If they open toward a corridor, there should be recessed vestibules. Doors should be at least

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107 cm (42 in.) wide and at least 213 cm (84 in.) high, to permit easy passage of racks and equipment. Doors should fit tightly within their frames, and both should be completely sealed to provide a barrier to prevent the entrance or harboring of vermin. Self-sealing sweep strips installed at the bottoms of the doors are desirable. Metal or metal-covered doors are preferable. They should be equipped with locks and kickplates and be self-closing. Recessed handles and locks are recommended. Viewing windows are desirable.

3. *Exterior Windows*

Exterior windows and skylights are undesirable in animal rooms, because they contribute to variations in environmental characteristics, such as temperature and photoperiod.

4. *Floors*

Floors should be smooth, waterproof, nonabsorbent, nonslip, wear-resistant, acid- and solvent-resistant, not susceptible to the adverse effects of detergents and disinfectants, and capable of supporting racks, equipment, and storage areas without becoming gouged, cracked, or pitted. Depending on the functions carried on in specific areas, floor materials should be monolithic or have a minimum of joints. Some materials that have proved satisfactory are epoxy aggregates, smooth hard-surfaced concrete, neoprene terrazzo, special hardened rubber-base aggregates, and other synthetic products. A continuous waterproof membrane may be needed. If sills are installed at the entrance to a room, they should be designed to allow for convenient passage of equipment.

5. *Drainage*

Floor drains may not be essential in all animal rooms, particularly those housing rodent species. Floors in such rooms can be maintained satisfactorily by wet vacuuming or by sweeping and mopping with appropriate disinfectants or cleaning compounds.

To allow flexibility for future use, it may be desirable to provide floor drains but not to slope the floors to the drains. If floor drains are used, the drainpipes should be at least 10.2 cm (4 in.) in diameter. If floors are sloped, the recommended minimal pitch of floors is 0.64 cm/m (0.25 in./yard). In heavy-use areas, such as dog kennels, rim flush drains at least 15.3 cm (6 in.) in diameter are recommended. A rim flush drain or heavy duty disposal unit set in the floor is an effective aid for the disposal of solid waste. A porous trap bucket in the drain can also be used to screen out solid waste. All drainpipes

should have short runs to the main or be steeply pitched from the opening. When drains are not in use, they should be capped and sealed to prevent backflow of sewer gases. Lockable drain covers are advisable for preventing the use of the drains for disposal of materials that should be swept up and removed by other means (see Section IV.G).

6. *Walls*

Walls should be free of cracks, utility penetrations, or imperfect junctions with doors, ceilings, and corners. Surface materials should be capable of withstanding scrubbing with detergents and disinfectants and of withstanding the impact of water under high pressure. Provision should be made for protecting walls from damage by movable equipment.

7. *Ceilings*

Ceilings should be smooth, waterproof, and free of imperfect junctions. Surface materials should be capable of withstanding scrubbing with detergents and disinfectants. Furred ceilings of plaster or fireproof plasterboard should be sealed and painted with a washable finish. Ceilings formed by the concrete floor above are satisfactory if properly smoothed, sealed, or painted. Exposed pipes and fixtures are undesirable.

8. *Ventilation, Temperature, and Humidity*

Effective ventilation is necessary to regulate room temperature and to promote comfort. Important factors for proper ventilation are temperature, humidity, air movement, and air pressure. The ability to control odor in animal facilities depends on the number and species of animals housed and on the sanitation practices, as well as on a ventilation system that is properly designed and operated. The animal facility and human occupancy areas should be ventilated separately. The system should provide frequent changes of room air without drafts, preferably 10–15 changes per hour. There should be no recirculation of room air, unless it has been treated to remove particulate or toxic gaseous contaminants. If energy-recovery devices are used, steps must be taken to minimize or eliminate the recirculation of contaminants.

Temperature control and humidity control are desirable in animal facilities and may be required by the nature of the program. Air conditioning is effective for such control. Research animal facilities may require more precise environmental controls than production facilities because environmental variation may affect

experimental results. Ideally, such a system will permit individual adjustments to within ±1° C (±2° F) for any temperature in a range of 18–29° C (65–84.2° F). The relative humidity should be kept at 30–70% throughout the year, according to the needs of the species being maintained. In institutions in which the entire animal facility or extensive portions of the facility are designed for species with similar requirements, the range of individual adjustments may be reduced. Each animal room or group of rooms serving a common purpose should have controls for the regulation of temperature and humidity.

Consideration should be given to control of air pressure in animal housing and service areas. For example, quarantine, isolation, soiled-equipment, and biohazard areas should be kept under negative pressure, whereas clean-equipment and pathogen-free animal housing areas should be kept under positive pressure.

9. *Power and Lighting*

The electric system should provide appropriate lighting, sufficient power outlets, and safety—e.g., by using explosionproof outlets or outlets placed 1.53 m (5 ft) off the floor in rooms where explosive anesthetics may be used and waterproof outlets where water is used in cleaning.

Lighting should be uniformly diffused throughout the area and provide adequate illumination for good housekeeping practices, adequate inspection of animals, and safe working conditions for personnel. Illumination of 75–125 ft-candles (807–1,345 lumens/m²) is recommended. Precise lighting requirements for maintenance of good health and physiologic stability of animals are not known. Provision of variable-intensity controls is an acceptable means of ensuring lighting intensity consistent with animal needs, needs of personnel when working in animal rooms, and energy conservation.

Fluorescent lights are efficient and are available in a variety of fixtures that can be sealed and surface-mounted on ceilings. Incandescent or fluorescent lights in tightly sealed fixtures hung from ceilings are acceptable. Light fixtures should be properly sealed, to prevent the harboring of vermin.

In windowless animal facilities, a time-controlled lighting system is recommended, to provide a regular diurnal lighting cycle.

Provision should be made for emergency power for ventilation and lighting in the event of a power failure.

10. *Storage Areas: Food and Bedding, Refuse, and Equipment*

In areas where delivery schedules are reliable, the amount of space required for food and bedding storage can be held to a minimum. The best practice is to maintain constant turnover.

Bulk supplies of food and bedding should not be stored in animal rooms. A separate verminproof area or room should be available in which food and bedding can be stored off the floor on pallets, racks, or carts. A continuing pest-control program is essential.

Food and storage areas should be separated from refuse areas (see Section I.C for storage recommendations).

Refrigerated storage for animal waste and dead animals is essential. This storage area should be separated from other cold storage, be used exclusively for refuse storage, and be kept below 7° C (45° F) to reduce putrefaction of wastes or animal carcasses. Obnoxious materials should be covered or packaged. The area should be so constructed that it can be kept clean and free of vermin. Freezers may be required for storage of hazardous biologic materials.

Adequate space for storage of unused equipment is essential. This area should also be so constructed that it can be kept clean and free of vermin.

11. *Noise control*

Noise from the animals and the animal-care routine is inherent in the operation of animal facilities. Noise may be undesirable, because of its effect on personnel and on the animals. Inasmuch as background and "operational" noises constitute an environmental factor in the control of animal experiments, they should be considered in the design of animal facilities.

Rats, mice, guinea pigs, cats, and hamsters do not create disturbing noises and should be housed away from noisy species. Noise from a monkey colony can be troublesome, and dogs are typically the cause of unwelcome noise: barking is disturbing to personnel working inside and outside the animal facilities; it may also pose important public relations problems, if there are residences near the laboratory.

Separation of human from animal areas is the best way to minimize disturbances to laboratory personnel from the sounds of animals and animal-care routines. In animal facilities, such noisy activities as cage washing and refuse disposal should be carried out in rooms or areas separate from the animal housing areas. Unwelcome noise from animal-care routines can be minimized by appropriate indoctrination and training of personnel and by the use of rubber-tired casters and rubber bumpers on carts, trucks, and racks.

Concrete walls are more effective than metal or plaster walls in containing sound, because their density reduces sound transmission. The elimination of windows also helps to contain sound. The use of acoustical materials in animal rooms by direct application to the ceiling or as part of a suspended ceiling presents problems of sanitation and vermin control and is not recommended.

12. *Facilities for Sanitizing Equipment and Supplies*

An area for sanitizing equipment and supplies is essential, to keep equipment physically clean, reduce obnoxious odors, and minimize the spread of infectious diseases. Sanitizing is best done in a central area specifically designed for the purpose. Consideration should be given to such factors as:

- Location with respect to animal rooms, traffic flow that separates "clean" and "dirty" areas, elevators, ease of access, and disposal of waste.
- Soundproofing.
- Utilities, such as hot and cold water, steam, floor drains, and electric power.
- Proximity to cage and equipment storage areas (it is essential to provide separate holding areas for soiled and clean equipment).
- Insulation of walls and ceilings where necessary.
- Ventilation with installation of proper vents and provisions for dissipation of steam.
- Access doors wide enough to ensure free movement of equipment.

The use of mechanical equipment-washing machines is highly recommended. The machines should provide both wash and rinse cycles, preferably with adjustable time settings for each. If sanitization depends on heat for effectiveness, the wash or rinse cycle, or both, should be conducted at a temperature of at least 82° C (180° F) for sufficient time to ensure destruction of vegetative pathogenic organisms.

Large pieces of equipment may have to be washed by hand. However, portable cleaners that dispense detergent and hot water or steam under pressure are more efficient than hand cleaning. Some institutions use a booth in the cage-washing area for rack washing. Such an area serves well when equipped with hot and cold water, steam, and a detergent dispenser. It should be vented to exhaust steam. If the size of the animal facility warrants such an investment, a large washing machine for racks, dog cages, and other large pieces of equipment is useful. If no machine is available, small cages can be washed by hand in a large sink or tub, with appropriate detergents, disinfectants, and vigorous scrubbing.

A machine for washing bottles and sipper tubes is recommended if large numbers of water bottles are used. Some cage-washing machines may also be used for this purpose. If bottles are washed by hand, powered rotating brushes at the washing sink are useful, and provision should be made for dipping or soaking the water bottles in detergent and disinfectant solutions. A two-compartment sink or tub is adequate for this purpose.

Some means of sterilization, such as an autoclave or a gas sterilizer, is essential for sterilizing equipment and supplies where pathogenic organisms are involved. An autoclave for sterilization of animal cages is essential if pathogenic agents are under investigation (see Section IV.G). In some specialized facilities—such as those for production colonies of cesarean-derived, defined environment animals—autoclaving or other methods of sterilization of food and bedding may be necessary. But routine sterilization of cages, food, and bedding is not considered essential if care is taken to use clean materials from reliable sources.

Provisions should be made to prevent the harmful accumulation of cleansing and sanitizing materials or their discharge in undesirable quantities into public waste systems or the environment.

E. Aseptic Surgery

A facility for aseptic surgery should be designed in accordance with all applicable local and state building codes.

Operating rooms should be equipped with appropriate surgical equipment and accessories. It is recommended that explosionproof outlets be used or outlets located 1.52 m (5 ft) off the floor. It may also be necessary to have a conductive floor. Exhaust-air registers should be near the floor, to remove heavier-than-air anesthetic gases, or there should be vacuum systems for connection to the exhaust of anesthetic machines.

A separate surgical preparation area should be provided.

An area equipped with surgical sinks should be apart from the operating area.

A surgical-support area should be provided, for storing instruments and supplies and for washing and sterilizing instruments.

There should be an area for intensive care and supportive treatment of animals during the recovery period. Equipment and supply items that may be helpful in the intensive-care area include heating pads, vaporizers, vacuum equipment, respirator, cardiac monitor, and oxygen.

Lockers and an area for dressing in surgical attire should be provided for personnel.

F. Large Domestic Animals

The requirements for large domestic animals used in most biomedical research projects are similar to those previously described. However, it may be necessary to house horses, cows, sheep, goats, or pigs under less stringent conditions, e.g., those animals used as blood donors, for immune serum production, or in agricultural experiments on the production of food and fiber. For these types of research needs, they are usually housed in pens and barns in rural areas. If such construction is planned, it is advisable to consult with agricul-

tural engineers or farm animal housing experts to obtain specific information.

G. Special Facilities for Conducting Animal Research with Hazardous Agents

If animal experiments are to involve hazardous biologic, chemical, or physical agents, special features and safety equipment are needed to protect the animal-care staff, other facility occupants, the laboratory animals, and the environment from exposure to such hazardous agents. Protection is achieved by keeping the hazardous agents used in experimentation in the environment of the study. Ventilated hoods and animal caging systems that minimize the escape of contaminants are primary barriers used to contain hazardous materials. Special features, such as airlocks and negative air pressure, are secondary barriers designed to protect against the accidental release of hazardous agents outside the animal facility. It is emphasized that special safety features are not substitutes for appropriate management and safe practices; rather, they are complementary. As a general rule, safety depends on the rigorous and proficient application of safe practices.

A moderate degree of containment should be provided for the use of most hazardous chemical and physical agents and for microorganisms known to be infectious to man or laboratory animals. A high degree of containment should be provided for the use of physical or chemical agents and microorganisms that are extremely hazardous to laboratory personnel or that may cause serious epidemic disease.

A moderate degree of containment can be provided by housing laboratory animals in partial-containment caging systems, such as Horsfall cubicles and ordinary animal cages fitted with filter bonnets. Cage racks equipped with ultraviolet radiation lamps and reflectors have proved effective in preventing the airborne spread of some infectious agents between cages.

A high degree of containment can be provided by housing laboratory animals in caging systems that totally separate the animals from the animal-care staff. Several types of closed and ventilated caging systems are available. A simple system involves a lid with ventilation ports that is made to fit an ordinary animal cage by use of gastight gaskets around the rim of the cage. The ventilation ports of the lid are connected to an air-supply filter and an exhaust system that is balanced to maintain negative pressure in the cage. Ordinary cages can also be housed in Class III safety cabinets (e.g., negative-pressure glove boxes). In some circumstances, a high degree of containment can be provided by the use of partial-containment caging systems in a specially designed "suit" area. A person who enters this area is protected by wearing a one-piece positive-pressure suit that is ventilated by a life-support system.

Ventilated cabinets or hoods should be used for the handling of hazardous agents, the inoculation of animals with hazardous agents,

and necropsy of contaminated animals. They should also be used to protect animal-care personnel performing procedures in which exposures could occur, such as when removing a filter bonnet from a cage. A moderate degree of containment can be provided by open-front ventilated cabinets or hoods. The inward air flow through the front opening of a cabinet or hood should have an air velocity of 75–100 ft/min (23–30 m/min). The exhaust air from a cabinet or hood should be treated before being discharged. The HEPA filter (high-efficiency particulate air filter), with a rated efficiency of 99.97% for 0.3μm particles, provides appropriate treatment for microorganisms and particulate contaminants. Hazardous agents that require a high degree of containment should be confined to Class III cabinets.

The selection of appropriate animal caging systems and ventilated cabinets or hoods depends on the nature of the hazardous agents under study, the type of animal used, and the experimental design. The selection requires the knowledge and discriminating judgment of the professional staff.

The following special features provide a moderate degree of secondary containment:

- The animal facility should be separated from areas that are open to unrestricted traffic flow within the building. Separation should be provided by either a double-door access vestibule, a double-door change room, an airlock, or some other access facility that requires passage through two sets of doors for access to the animal facility. Shower facilities and clothing change areas should be available.

- The surfaces of walls, floors, and ceilings should be impervious and readily cleanable. Penetrations of these surfaces should be sealed or capable of being sealed, to facilitate space decontamination.

- Animal room doors should be self-closing.

- Facilities for decontamination or safe removal of wastes and contaminated materials should be available in the same building as the animal facility (see Section I.B).

- Mechanical exhaust ventilation should be provided. The exhaust system should maintain a flow of air into the animal rooms. The exhaust air should be discharged to the outside, clear of occupied buildings and air intakes. The exhaust air should not be recirculated unless appropriately treated.

The following special features provide a high degree of secondary containment:

- The animal facility should be either in a separate building or in a clearly demarcated and isolated zone in a building. A change room and a shower facility should be provided for personnel entry and exit. These facilities should be arranged so that personnel exit through the shower area to the change room. A double-door ventilated vestibule or airlock should be provided for passage of

materials, supplies, and equipment that are not brought into the facility through the change room.

- Walls, floors, and ceilings of the facility should be so constructed as to form a sealed internal shell that readily allows fumigation and is animalproof and insectproof. The internal surfaces of this shell should be impervious and resistant to compounds used for decontamination. All penetrations of these structures and surfaces should be sealed.

- Internal appurtenances—such as light fixtures, air ducts, and utility pipes—should be so arranged as to minimize exposed horizontal surfaces.

- Animal room doors should be self-closing.

- Where highly infectious agents are used, a double-door autoclave should be provided for sterilization of material passing out of the facility. The autoclave door that opens to the area outside the facility should be automatically controlled, so that it can be opened only after completion of the sterilization cycle.

- A pass-through dunk tank or fumigation chamber should be provided, for safe removal from the facility of material and equipment that cannot be heat-sterilized.

- All liquid-effluent drain lines of the facility—including those from sinks, showers, toilets, cabinets, floors, and autoclaves—should be connected to a heat-sterilization facility. All liquid traps in the lines should be extra deep, to prevent transient backflow. The liquid effluent from showers may be separately collected and inactivated by chemical treatment. HEPA filters should be installed in all drain vent lines.

- An individual supply- and exhaust-air ventilation system should be provided. The system should maintain pressure differences and directional air flow as required to ensure flow *from* areas outside the animal facility *toward* areas of greatest potential risk. The supply- and exhaust-air fans should be interlocked to ensure inward (or zero) air flow at all times.

- The exhaust air from the facility should be filtered by HEPA filters and discharged to the outside, so that it is dispersed clear of occupied buildings and air intakes. The filters should be placed as close as practical to individual animal rooms in the facility, to reduce the length of potentially contaminated air ducts. The filter chambers should be designed to allow *in situ* decontamination before removal and to facilitate certification testing after replacement. Coarse filters should be provided in the animal rooms to increase the lifetime of the HEPA filters.

- A specially designed "suit" area may be provided in the animal facility. Personnel who enter this area should wear a one-piece

positive-pressure suit that is ventilated by a life-support system. The life-support system should be provided with alarms and an emergency backup tank of air. Entry to this area is through an airlock fitted with airtight doors. A chemical shower area should be provided to decontaminate the surfaces of the suit before removal. The exhaust air from the suit area should be filtered by two sets of HEPA filters installed in series. A duplicate filtration unit and exhaust fan should be provided, and there should be an emergency power system. The air pressure in the suit areas should be less than that in any adjacent area. Emergency lighting and communication systems should be provided. The internal shell of the suit area should be airtight. A double-door autoclave should be provided for sterilization of all waste materials to be removed from the suit area.

H. Space Recommendations for Laboratory Animals

The size of a cage, pen, run, or other enclosure and the number of animals to be housed in each are matters of professional judgment. The following recommendations are based on the best available information concerning reasonable space allocations for the housing of animals in experimental use. *Cage and pen areas other than those suggested here should be considered equally acceptable if they provide equivalent comfort for the animals.* The marked variations in body conformation, postural preferences, and locomotor characteristics require careful application of professional judgment in selection of cages for laboratory animals. The adequacy of the housing system must be under continuous review. Legal specifications applying to the housing of some species of animals are stated in the regulations promulgated under the Animal Welfare Act of 1966, as amended in 1970 and 1976 (see Appendix V).

SPACE RECOMMENDATIONS FOR LABORATORY ANIMALS

Animals	Weight	Type of Housing	Floor Area/ Animal	Height[a]
Mice	< 10 g	Cage	39 cm^2 (6 $in.^2$)	12.7 cm (5 in.)
	10–15 g	Cage	52 cm^2 (8 $in.^2$)	12.7 cm (5 in.)
	16–25 g	Cage	77 cm^2 (12 $in.^2$)	12.7 cm (5 in.)
	> 25 g	Cage	97 cm^2 (15 $in.^2$)	12.7 cm (5 in.)
Rats	< 100 g	Cage	110 cm^2 (17 $in.^2$)	17.8 cm (7 in.)
	100–200 g	Cage	148 cm^2 (23 $in.^2$)	17.8 cm (7 in.)
	201–300 g	Cage	187 cm^2 (29 $in.^2$)	17.8 cm (7 in.)
	> 300 g	Cage	258 cm^2 (40 $in.^2$)	17.8 cm (7 in.)
Hamsters	< 60 g	Cage	64.5 cm^2 (10.0 $in.^2$)	15.2 cm (6 in.)
	60–80 g	Cage	83.9 cm^2 (13.0 $in.^2$)	15.2 cm (6 in.)
	81–100 g	Cage	103.2 cm^2 (16.0 $in.^2$)	15.2 cm (6 in.)
	> 100 g	Cage	122.6 cm^2 (19.0 $in.^2$)	15.2 cm (6 in.)
Guinea pigs	≤ 350 g	Cage	277 cm^2 (43 $in.^2$)	17.8 cm (7 in.)
	> 350 g	Cage	652 cm^2 (101 $in.^2$)	17.8 cm (7 in.)
Rabbits	< 2 kg	Cage	0.14 m^2 (1.5 ft^2)	35.6 cm (14 in.)
	2–4 kg	Cage	0.28 m^2 (3.0 ft^2)	35.6 cm (14 in.)
	4–6 kg	Cage	0.37 m^2 (4.0 ft^2)	35.6 cm (14 in.)
	> 6 kg	Cage	0.46 m^2 (5.0 ft^2)	35.6 cm (14 in.)
Cats	≤ 4 kg	Cage	0.28 m^2 (3.0 ft^2)	61.0 cm (24 in.)
	> 4 kg	Cage	0.37 m^2 (4.0 ft^2)	61.0 cm (24 in.)
Dogs[b]	< 15 kg	Pen or run	0.74 m^2 (8.0 ft^2)	—
	15–30 kg	Pen or run	1.11 m^2 (12.1 ft^2)	—
	> 30 kg	Pen or run	2.23 m^2 (24.0 ft^2)	—
	< 15 kg	Cage	0.74 m^2 (8.0 ft^2)	81.3 cm (32 in.)
	15–30 kg	Cage	1.11 m^2 (12.1 ft^2)	91.4 cm (36 in.)
	> 30 kg	Cage	[b]	[b]
Primates[c]				
Group 1	≤ 1 kg	Cage	0.15 m^2 (1.6 ft^2)	50.8 cm (20 in.)
Group 2	≤ 3 kg	Cage	0.28 m^2 (3.0 ft^2)	76.2 cm (30 in.)
Group 3	≤ 15 kg	Cage	0.40 m^2 (4.3 ft^2)	76.2 cm (30 in.)
Group 4	> 15 kg	Cage	0.74 m^2 (8.0 ft^2)	91.4 cm (36 in.)
Group 5	> 25 kg	Cage	2.32 m^2 (25.1 ft^2)	213.4 cm (84 in.)
Pigeons	—	Cage	1451.7 cm^2 (115 $in.^2$)	[d]
Coturnix quail	—	Cage	232.3 cm^2 (36 $in.^2$)	[d]
Chickens	< 0.5 kg	Cage	232.3 cm^2 (36 $in.^2$)	[d]
	0.5–2 kg	Cage	464.5 cm^2 (72 $in.^2$)	[d]
	2–4 kg	Cage	1090.4 cm^2 (169 $in.^2$)	[d]
	> 4 kg	Cage	1651.7 cm^2 (256 $in.^2$)	[d]
Sheep and goats	< 25 kg	Pen	0.93 m^2 (10 ft^2)	—
	25–50 kg	Pen	1.39 m^2 (15 ft^2)	—
	> 50 kg	Pen	1.86 m^2 (20 ft^2)	—

SPACE RECOMMENDATIONS FOR LABORATORY ANIMALS

Animals	Weight	Type of Housing	Floor Area/ Animal	Height[a]
Swine	< 50 kg	Pen	0.56 m^2 (6 ft^2)	—
	50–100 kg	Pen	1.11 m^2 (12 ft	
	> 100 kg	Pen	2.79 m^2 (30 ft^2)	—
Cattle	< 350 kg	Stanchion	1.49 m^2 (16 ft^2)	—
	350–450 kg	Stanchion	1.77 m^2 (18 ft^2)	—
	451–550 kg	Stanchion	1.95 m^2 (22 ft^2)	—
	551–650 kg	Stanchion	2.23 m^2 (24 ft^2)	—
	> 650 kg	Stanchion	2.51 m^2 (27 ft^2)	—
	< 75 kg	Pen	2.23 m^2 (24 ft^2)	—
	75–200 kg	Pen	4.64 m^2 (51 ft^2)	—
	201–500 kg	Pen	9.29 m^2 (100 ft^2)	—
	501–600 kg	Pen	11.15 m^2 (121 ft^2)	—
	601–700 kg	Pen	13.01 m^2 (140 ft^2)	—
	> 700 kg	Pen	13.94 m^2 (151 ft^2)	—
Horses	—	Tie stall	4.09 m^2 (44 ft^2)	—
	—	Pen	13.38 m^2 (144 ft^2)	—

[a] From the resting floor to the cage top.

[b] These recommendations may require modifications according to the body conformation of particular breeds. As a further general guide, the height of a dog cage should be equal to the height of the dog over the shoulders (at the withers) plus at least 6 in. (15.2 cm), and the width and depth of the cage should each be equal to the length of the dog from the tip of the nose to the base of the tail plus at least 6 in. (15.2 cm).

[c] The primates are grouped according to approximate size. Examples of species that may be included in the various groups are:

Group 1—marmosets, tupaias, and infants of various species
Group 2—cebus and similar species
Group 3—macaques and large African species
Group 4—baboons, and nonbrachiating monkeys larger than 15 kg
Group 5—great apes and brachiating species

If primates are housed in groups in pens, only compatible animals should be kept. The minimal height of pens should be 6 ft (1.83 m). Resting perches and appropriate shelter should also be provided. In all cages, the minimal cage height for chimpanzees and brachiating species (orangutans, gibbons, and spider and woolly monkeys) should be such that the animal can swing from the cage ceiling without having its feet touch the floor of the cage when fully extended.

[d] Sufficient headroom must be provided for birds to stand erect.

Appendix I:

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Appendix II:

PROFESSIONAL AND CERTIFYING LABORATORY ANIMAL SCIENCE ORGANIZATIONS

American Association for Accreditation of Laboratory Animal Care (AAALAC), 2317 W. Jefferson St., Suite 135, Joliet, Illinois 60435 (815) 729-2024.

This nonprofit corporation was formed in 1965 by leading American scientific and educational organizations to promote high-quality standards of animal care through a voluntary accreditation program. The animal-care facilities of applicant institutions are visited and thoroughly evaluated by two experts in laboratory animal science, who submit a detailed report to the Council on Accreditation. Following the standards listed in the *Guide for the Care and Use of Laboratory Animals*, the Council on Accreditation reviews applications for accreditation and site visitors' reports to determine whether AAALAC should grant full accreditation or provisional accreditation or should withhold accreditation. Accredited facilities submit annual reports on the status of their animal facilities to AAALAC, and site revisits to accredited facilities are conducted at intervals of 3 years or less. The Council reviews the annual reports and the results of the site revisit reports to determine whether AAALAC should grant continued full accreditation or probationary accreditation or should withdraw accreditation.

Fully accredited animal-care facilities receive a certificate of accreditation and are included on a list of accredited facilities published in the Association's Activities Report. Full accreditation by AAALAC is accepted by the National Institutes of Health as assurance that the animal facilities are evaluated in accordance with DHEW policy on laboratory animals.

Any institution maintaining, using, importing, or breeding laboratory animals for scientific purposes is eligible to apply for AAALAC accreditation.

American Association for Laboratory Animal Science (AALAS), 2317 W. Jefferson St., Suite 208, Joliet, Illinois 60435 (815) 729-1161

The American Association for Laboratory Animal Science is an organization made up of individuals and institutions professionally concerned with the production, care, and use of laboratory animals. It provides a means for collection and exchange of information on all phases of laboratory animal care and management. The Association meets annually and publishes a bi-monthly journal entitled *Laboratory Animal Science,* the *AALAS Bulletin,* and other publications.

The Association's Animal Technician Certification Board provides a means of developing uniform standards for technician training by defining the qualifications, by preparing and approving examinations for training programs, and by certifying successful candidates.

American College of Laboratory Animal Medicine (ACLAM), c/o Dr. William S. Webster, Secretary-Treasurer, Department of Animal Medicine, University of Massachusetts Medical School, 55 Lake Ave., North Worcester, Massachusetts 01605 (617) 856-3151

The American College of Laboratory Animal Medicine is a specialty board recognized by the American Veterinary Medical Association (AVMA). It was founded in 1957, and its purposes are to encourage education, training, and research; to establish standards of training and experience for qualification; and to certify, by examination, qualified laboratory animal specialists as diplomates. To achieve these goals, the College seeks to interest veterinarians in furthering both training and qualifications in laboratory animal medicine.

ACLAM meets biannually in conjunction with the AVMA and the American Association for Laboratory Animal Science; emphasizes and sponsors continuing-education programs; cosponsors symposia; cosponsors approximately 30 autotutorial programs on use, husbandry, and diseases of animals commonly used in research; and publishes texts, such as *The Biology of the Laboratory Rabbit,* and *The Biology of the Guinea Pig.*

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American Society of Laboratory Animal Practitioners (ASLAP), c/o Dr. Ronald L. Bell, Secretary-Treasurer, The Ohio State University, College of Medicine, 333 West 10th Ave., Columbus, Ohio 43210 (614) 422-9412

The Society, founded in 1966, is open to any veterinarian who is a graduate of a veterinary college accredited or recognized by the American Veterinary Medical Association (AVMA) or the Canadian Veterinary Medical Association (CVMA), who is engaged in laboratory animal practice, and who maintains membership in the AVMA, the CVMA, or any other national veterinary medical association recognized by the AVMA. Its purpose is to promote the dissemination of ideas, experiences, and knowledge among veterinarians engaged in laboratory animal practice through education, training, and research at both predoctoral and postdoctoral levels. Two educational meetings are held annually, one each in conjunction with the AVMA and American Association for Laboratory Animal Science conventions.

Appendix III:

TRAINING PROGRAMS IN LABORATORY ANIMAL MEDICINE, COMPARATIVE MEDICINE, AND COMPARATIVE PATHOLOGY

The purpose of these programs is to provide summer fellowship training for undergraduate veterinary students or broad basic training for graduate veterinarians who desire to teach; study laboratory animal medicine, comparative medicine, or comparative pathology; or serve as professional directors of laboratory animal facilities.

A. NIH-SPONSORED TRAINING PROGRAMS

Location	Address
Alabama	Department of Comparative Medicine University of Alabama Medical Center Birmingham, Alabama 35294 Training: SF, PD*
Florida	Department of Laboratory Animal and Wildlife Medicine J. Hillis Miller Health Center University of Florida Gainesville, Florida 32610 Training: SF, PD
Maryland	Division of Comparative Medicine School of Medicine The Johns Hopkins University Baltimore, Maryland 21205 Training: SF, PD

* Explanation of training offered: SF = summer fellow program for veterinary students; PD = postdoctoral training for persons having the D.V.M. or equivalent degree.

Location	Address
Massachusetts	New England Regional Primate Research Center Harvard University Medical School Southborough, Massachusetts 01772 Training: SF, PD
Michigan	Unit for Laboratory Animal Medicine University of Michigan Medical School Ann Arbor, Michigan 48109 Training: SF, PD
Missouri	Sinclair Comparative Medicine Research Farm University of Missouri Route No. 3 Columbia, Missouri 65201 Training: SF, PD
North Carolina	Department of Comparative Medicine Bowman Gray School of Medicine Wake Forest University Winston-Salem, North Carolina 27103 Training: SF, PD
Pennsylvania	Department of Comparative Medicine Milton S. Hershey Medical Center Pennsylvania State University Hershey, Pennsylvania 17033 Training: SF, PD

B. PRECEPTORSHIPS AND RESIDENCIES

California	Animal Resources Service School of Veterinary Medicine University of California Davis, California 95616 Training: SF, PD
California	California Primate Research Center

Location	Address
	University of California Davis, California 95616 Training: PD only
Colorado	Animal Care Facility University of Colorado Medical Center 4200 East Ninth Ave. Denver, Colorado 80262 Training: SF and interim
Connecticut	Section of Comparative Medicine Yale University School of Medicine 375 Congress Ave. New Haven, Connecticut 06510 Training: SF, PD
Iowa	Laboratory Animal Resources College of Veterinary Medicine Iowa State University Ames, Iowa 50011 Training: SF, PD
Louisiana	Department of Vivarial Science and Research Tulane University School of Medicine 1430 Tulane Ave. New Orleans, Louisiana 70112 Training: PD only
Louisiana	Delta Regional Primate Research Center Tulane University Covington, Louisiana 70433 Training: SF only
Maryland	Rockville Primate Facility Meloy Laboratories, Inc. 2501 Research Blvd. Rockville, Maryland 20850 Training: SF and interim
Massachusetts	Division of Laboratory Animal Medicine Massachusetts Institute of Technology Building 45, 18 Vassar St. Cambridge, Massachusetts 02139 Training: SF only

Location	Address
Michigan	Department of Comparative Medicine Wayne State University 1400 Chrysler Freeway Detroit, Michigan 48207 Training: SF, PD
Minnesota	Laboratory Animal Facilities Mayo Clinic Rochester, Minnesota 55901 Training: SF and interim
New York	Laboratory Animal Medicine and Services New York State College of Veterinary Medicine Cornell University Ithaca, New York 14853 Training: SF only
New York	Division of Laboratory Animal Medicine School of Medicine and Dentistry The University of Rochester 260 Crittenden Blvd. Rochester, New York 14620 Training: SF, PD
North Carolina	Division of Laboratory Animal Medicine University of North Carolina Chapel Hill, North Carolina 27514 Training: SF, PD
Ohio	Department of Laboratory Animal Medicine R-351 Medical Sciences Bldg. University of Cincinnati School of Medicine Cincinnati, Ohio 45267 Training: SF only
Oklahoma	Division of Comparative Medicine University of Oklahoma Health Sciences Center P.O. Box 26901 Oklahoma City, Oklahoma 73190 Training: PD only

Location	Address
Pennsylvania	Laboratory Animal Resources Pennsylvania State University University Park, Pennsylvania 16802 Training: SF only
Tennessee	Animal Resources Division University of Tennessee Center for the Health Sciences Memphis, Tennessee 38163 Training: SF only
Texas	Department of Veterinary Public Health College of Veterinary Medicine Texas A&M University College Station, Texas 77843 Training: PD
Texas	Division of Comparative Medicine University of Texas Southwestern Medical School 5323 Harry Hines Blvd. Dallas, Texas 75235 Training: SF, PD
Texas	University of Texas System Cancer Center Texas Medical Center Houston, Texas 77025 Training: SF, PD
Texas	Department of Comparative Medicine University of Texas Medical School at Houston 6400 West Cullen St. Houston, Texas 77030 Training: PD only
Texas	University of Texas Health Science Center 7703 Floyd Curl Dr. San Antonio, Texas 78284 Training: SF only
Washington	Division of Animal Medicine School of Medicine University of Washington Seattle, Washington 98195 Training: SF, PD

Location	Address
Wisconsin	Research Animals Resources Center University of Wisconsin Madison, Wisconsin 53706 Training: PD only

C. PROGRAMS FOR VETERINARIANS IN GOVERNMENTAL SERVICES

District of Columbia	Division of Veterinary Resources Walter Reed Army Institute of Research Washington, D.C. 20012 Training: PD (limited to persons in uniformed services)
Maryland	Animal Resources Division U.S. Army Medical Research Institute of Infectious Diseases Department of the Army Fort Dietrick, Maryland 21701 Training: PD (limited to persons in uniformed services)
Maryland	Veterinary Resources Branch Biomedical Laboratory, U.S. Army Edgewood Arsenal, APG, Maryland 21010 Training: PD (limited to persons in uniformed services)
Texas	Comparative Medicine Section Veterinary Education Branch USAF School of Aerospace Medicine (AFSC) Brooks Air Force Base, Texas 78235 Training: PD (limited to persons in uniformed services)

Appendix IV:

ANIMAL TECHNOLOGY PROGRAMS

Animal technology programs are offered by a large number of institutions. However, because programs change, the Committee on Care and Use of Laboratory Animals believes that it would be best for interested persons to request current information from the national office of the American Association for Laboratory Animal Science, 2317 W. Jefferson St., Suite 208, Joliet, Illinois 60435 (815) 729-1161.

Location	Address
California	Animal Health Technology Program Cosumnes River College 8401 Center Parkway Sacramento, California 95823
Canada	Animal Care Technology Program St. Lawrence College of Applied Arts and Technology Kingston, Ontario, Canada
Colorado	Bel-Rea Institute of Animal Technology 9870 E. Alameda Denver, Colorado 80231
Colorado	Animal Health Technology Colorado Mountain College, West Campus Glenwood Springs, Colorado 81601
Connecticut	Laboratory Animal Technology Program Quinnipiac College Mount Carmel Ave. Hamden, Connecticut 06518
Florida	Animal Science Technology St. Petersburg Junior College St. Petersburg, Florida 33733

Location	Address
Kansas	Animal Technology Program Veterinary Hospital Curriculum Colby Community College Colby, Kansas 67701
Maine	Animal Medical Laboratory Science Department of Animal and Veterinary Sciences University of Maine Orono, Maine 04473
Maine	Animal Medical Technology Curriculum Department of Animal and Veterinary Sciences University of Maine Orono, Maine 04473
Massachusetts	Laboratory Animal Technology Training Program Department of Veterinary and Animal Science Stockbridge School of Agriculture University of Massachusetts Amherst, Massachusetts 01003
Michigan	Animal Technology Program College of Veterinary Medicine 127D Giltner Hall Michigan State University East Lansing, Michigan 48824
Minnesota	Animal Health Technology Program University of Minnesota Technical College, Waseca Waseca, Minnesota 56093
New Jersey	Camden County College P.O. Box 200 Blackwood, New Jersey 08012
New York	Veterinary Science Technology Program Agricultural and Technical College State University of New York Delhi, New York 13753

Location	Address
New York	Animal Technology Department of Biological Sciences Agricultural and Technical College State University of New York Farmingdale, New York 11735
North Carolina	Veterinary Medical Technology Department Central Carolina Technical Institute Sanford, North Carolina 27330
Ohio	Animal Care Technology Program University of Cincinnati Raymond Walters Branch 9555 Plainfield Rd. Cincinnati, Ohio 45236
Ohio	Laboratory Animal Medicine University of Cincinnati R-351 Medical Sciences Building 231 Bethesda Ave. Cincinnati, Ohio 45267
Texas	Biomedical Science Program College of Veterinary Medicine Texas A&M University College Station, Texas 77843
Texas	Texas State Technical Institute James Connally Campus Waco, Texas 76705
Washington	Animal Technology Program Fort Steilacoom Community College 9401 Farwest Dr. SW Tacoma, Washington 98498
Washington	Veterinary Technician Training Program Northwest College 1305 Seneca St. Seattle, Washington 98101
Wisconsin	Madison Area Technical College 211 No. Carroll St. Madison, Wisconsin 53703

Appendix V:

RELEVANT FEDERAL LAWS AND IMPLEMENTING RULES AND REGULATIONS

Animal Welfare

The Animal Welfare Act of 1966 (Public Law 89-544), as amended by the Animal Welfare Act of 1970 (Public Law 91-579) and by the 1976 Amendments to the Animal Welfare Act (Public Law 94-279), contains provisions to protect the owners of animals from theft of their animals, to prevent the sale or use of animals that have been stolen, to restrict animal fighting ventures, and to ensure that animals intended for use in research facilities or for exhibition purposes or for use as pets, or that are transported by common carrier or intermediate handler, receive humane care and treatment. The law provides for regulating the transportation, purchase, sale, housing, care, handling, and treatment of animals used in research, for exhibition, and for certain other purposes.

Implementing rules and regulations are published in the Code of Federal Regulations (CFR), Title 9 (Animals and Animal Products), Subchapter A—Animal Welfare, Parts 1, 2, and 3. All amendments to the rules and regulations are periodically published in the Federal Register under the heading, Department of Agriculture, Animal and Plant Health Inspection Service. Copies of the rules and regulations can be obtained from the Offices of the Deputy Administrator, U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Federal Building, 6505 Belcrest Road, Hyattsville, Maryland 20782.

Endangered Species

The Endangered Species Act of 1973 (Public Law 93-205; 87 Stat. 884) became effective on December 28, 1973, and thereby supplanted the previous Endangered Species Conservation Act of 1969 (Public Law 91-135; 83 Stat. 275). The new law seeks "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to

achieve the purposes of the treaties and conservation of wild flora and fauna worldwide."

The implementing rules and regulations for this Act are published in the CFR, Title 50 (Wildlife and Fisheries), Chapter 1 (Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Department of Interior). Amendments are published in the Federal Register under the Title.

A list of the animal species currently considered endangered or threatened can be obtained by writing to the Office of Endangered Species, U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. 20240.

National Institutes of Health Guidelines for the Use of Experimental Animals

It is a longstanding National Institutes of Health (NIH) policy that grantees and contractors using live, vertebrate animals in projects or activities supported by NIH follow the guidelines prescribed for their care and use in this *Guide*. The PHS Grants Administration Manual, in Chapter 1-43 ("Responsibility for Care and Use of Animals"), requires that institutions assure NIH in writing that they are committed to follow this *Guide*. In addition, that chapter requires that an institution either be accredited by the American Association for Accreditation of Laboratory Animal Care (AAALAC) or have an institutional committee that reviews its animal facilities and practices for compliance with this *Guide*. It also charges NIH staff, advisory groups, and reviewers with the responsibility to consider the animal welfare policies and principles in their review of all applications. The staff and reviewers are directed to pay special attention to a set of principles regarding the use of laboratory animals. These principles are as follows.

The Personnel

1. Experiments involving live, vertebrate animals and the procurement of tissues from living animals for research must be performed by, or under the immediate supervision of, a qualified biological, behavioral, or medical scientist.
2. The housing, care, and feeding of all experimental animals must be supervised by a properly qualified veterinarian or other scientist competent in such matters.

The Research

3. The research should be such as to yield fruitful results for the good of society and not random or unnecessary in nature.
4. The experiment should be based on knowledge of the disease or

problem under study and so designed that the anticipated results will justify its performance.

5. Statistical analysis, mathematical models or *in vitro* biological systems should be used when appropriate to complement animal experiments and to reduce numbers of animals used.
6. The experiment should be conducted so as to avoid all unnecessary suffering and injury to the animals.
7. The scientist in charge of the experiment must be prepared to terminate it whenever he believes that its continuation may result in unnecessary injury or suffering to the animals.
8. If the experiment or procedure is likely to cause greater discomfort than that attending anesthetization, the animals must first be rendered incapable of perceiving pain and be maintained in that condition until the experiment or procedure is ended. The only exception to this guideline should be in those cases where the anesthetization would defeat the purpose of the experiment and data cannot be obtained by any other humane procedure. Such procedures must be carefully supervised by the principal investigator or other qualified senior scientist.
9. Post-experiment care of animals must be such as to minimize discomfort and the consequences of any disability resulting from the experiment in accordance with acceptable practices in veterinary medicine.
10. If it is necessary to kill an experimental animal, the animal must be killed in a humane manner; i.e., in such a way as to ensure immediate death in accordance with procedures approved by an institutional committee. *No animal shall be discarded until after it is dead.*

The Facilities

11. Standards for the construction and use of housing, service, and surgical facilities should meet those described in the publication, *Guide for the Care and Use of Laboratory Animals,* DHEW No. (NIH) 78-23, or as otherwise required by the U.S. Department of Agriculture regulations established under the terms of the Laboratory Animal Welfare Act (P.L. 89-544) as amended 1970 and 1976 (P.L. 91-579 and P.L. 94-279).

Transportation

12. Transportation of animals must be in accord with applicable standards and regulations, especially those intended to reduce discomfort, stress to the animals, or spread of disease.
    All animals being received for use as experimental subjects, having arrived at the terminal of a common carrier must be

picked up and delivered, uncrated, and placed in acceptable permanent facilities promptly.

If reviewers or review staff identify a situation in which they believe that an institution or investigator is not in compliance with these policies or principles, that should be indicated with a special note on the project review summary statement. It is the responsibility of Department of Health, Education, and Welfare operating staff to inform institutions and investigators of such situations and to resolve these matters before making an award.

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